

# NICE Evaluations: Overview of (mostly) AGU 2011

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# Announcements

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- **Coming soon!** Discussions about common evaluation elements across the three agencies (NASA, NOAA, NSF). **Keep an eye on your email.**
- **Preliminary discussion** of an **evaluation strand** at the 2012 tri-agency PI meeting: more info to come.
- Ann Martin ([ann.m.martin@nasa.gov](mailto:ann.m.martin@nasa.gov)) is collecting evaluation/education research materials from NICE projects (evaluation/research plans, logic models, instruments, publications and/or evaluation reports). I'll be working with both PIs and evaluators, **so email me** if you have something to share.

# Projects in Today's Presentation

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- We'll look at materials from:
  - Karen McNeal, on Earth System Science (TERC)
    - ✦ Poster ED11B-0777: McNeal (karen.mcneal@msstate.edu), Libarkin, Ledley, Dutta, Templeton, Geroux, & Blakeney
  - Susan Powers, PI on Climate Change Literacy in New York State (Clarkson University) and co-authors
    - ✦ Poster ED43B-0550: Suresh Dhaniyala (sdhaniya@clarkson.edu), Jan DeWaters, and Susan E. Powers (sep@clarkson.edu); we'll hear from Mary Margaret Small, mmsmall@clarkson.edu
  - Susan Buhr, PI on ICEE (University of Colorado), and co-authors
    - ✦ Poster ED11B-0781: Susan Lynds (susan.lynds@colorado.edu) & Susan Buhr
  - Nicole Holthuis, evaluator on Science and Policy of GCC (Stanford University)
    - ✦ Poster ED11B-0784: Nicole Holthuis (nch@stanford.edu), Saltzman, Lotan, Mastrandrea, Diffenbaugh, Gray & Kloser
  - Bob Bleicher, PI on PEL (Cal State Channel Islands) & Julie Lambert, PI on CSI-South Florida (Florida Atlantic University)
    - ✦ Poster ED11B-0783: Bob Bleicher (bob.bleicher@csuci.edu), Comfort, Getty, Lambert, & Zalles
  - Gillian Roehrig, PI on CYCLES (University of Minnesota)
    - ✦ Oral ED24A-07: Campbell, Gillian Roehrig (roehro13@umn.edu), Dalbotten, Bhattacharya, Nam, Varma & Wang
  - Rachel Becker-Klein, evaluator on Eco-Schools (NWF)
    - ✦ Not at AGU, but shared some info (rachel@peerassociates.net)
- If you have interest in using/adapting/ otherwise working with any of these materials, **please contact the project.**

# Please share . . .

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- A **brief** summary of your evaluation approach for this project.
- Information on the instruments/tools presented in the slides.
- Any lessons learned, recommendations for use, or other information that would be **useful for colleagues** who might be considering trying something similar.

# Fair warning . . .

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- Our goal: **get a conversation going** about the evaluation approaches/lenses, designs, and instruments you may be using on your own projects.

# Evaluation Designs

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- Guided by:
  - Project goals (and activities/audience)
  - Evaluation/research questions
  - External constraints (funding, time, policies)
- Need data! (**Evaluators are data hounds!**)
  - A range of frameworks and data collection methods

# Data Collection & Instruments

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- Who?
- What?
- When?
- Where?
- Why?
- How?

# Poster ED11B-0777: McNeal, Libarkin, Ledley, Dutta, Templeton, Geroux, & Blakeney

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- “Understanding Student Cognition about Complex Earth System Processes Related to Climate Change.”
- Focuses on:
  - How students process information in EarthLabs modules to undergo conceptual change.
- Evaluation plan incorporates:
  - Pre- and post-testing of awareness, conceptual understanding, and confidence about Earth system science.
  - Eye movement tracking while students interact with labs

## ESS Research Questions and Assessment Instruments

How do students engage with the ESS Earthlabs materials?

Classroom Observations, Eye-tracking

How does students' conceptual knowledge of ESS change?

Pre-post Open-Ended Questionnaire, Teacher Reports

How does students' process understanding of ESS change?

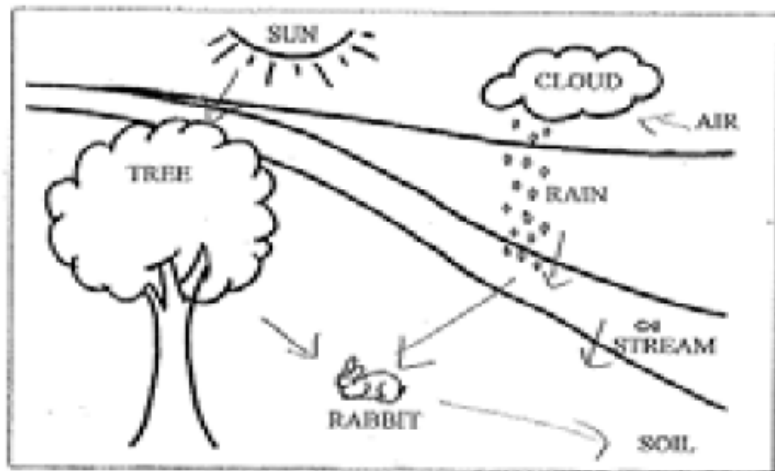
Pre-post Open-Ended Questionnaire, Teacher Reports

How does students' confidence in their ability to respond to questions pertaining to ESS change?

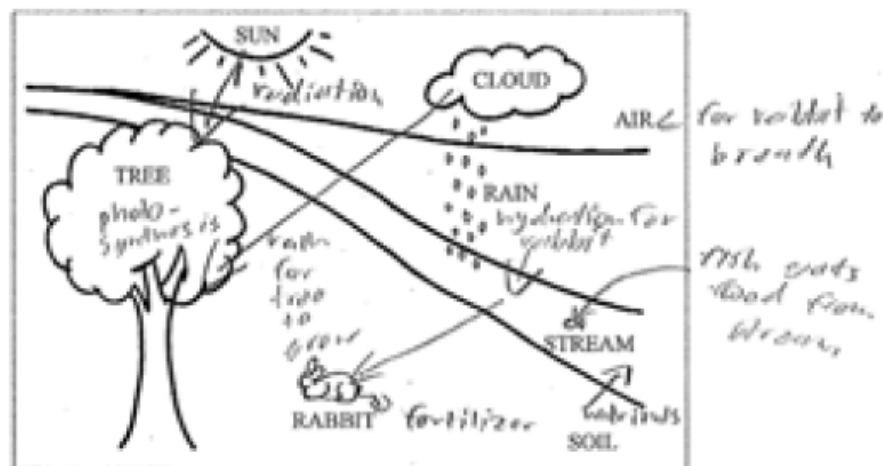
Pre-post Likert Scale Question Responses

## Preliminary Finding 4: Students increase understanding of ESS interactions

Question: The following diagram represents a region in the continental United States. **Draw and label** arrows to represent ALL of the important processes that move or change energy, water, or chemicals in this region.

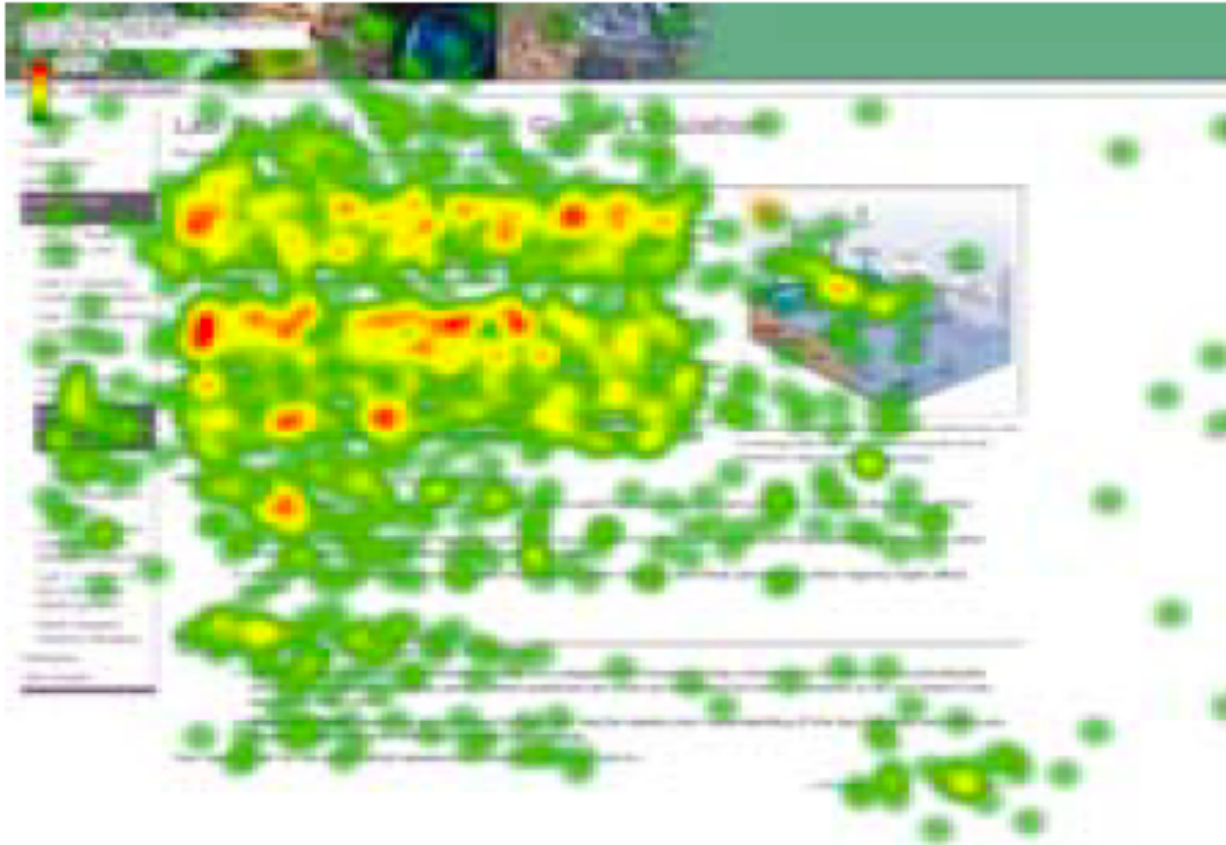


Pre



Post

## Student Heat Map of ESS EarthLab #5



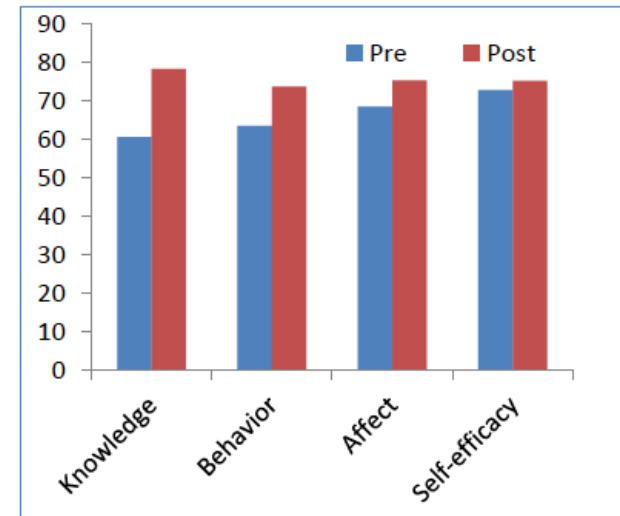
- ❑ Heat map showing areas of more or less gaze are provided just after discussion of a specific image. Red indicates areas of more gaze and green indicates areas of less gaze. Heat maps are for all students.

# Poster ED43B-0550: Dhaniyala, DeWaters, & Powers

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- “Climate Change Education for Engineering Undergraduate Students.”
- Focuses on:
  - Development of a new undergraduate climate course, aimed primarily at engineering students.

Part I. General	Pre-course	Post-course	p*
Question 9: How much do you feel you know about global climate change?	29.6	82.6	<0.001
Part II. Affect			
Question 12: How convinced are you that global warming is happening?	81.5	100.0	0.013
Question 17: Increasing taxes on electricity so people use less of it.	40.7	69.6	0.026
Part III. Self Efficacy			
Question 16: Life on earth will continue without major disruptions only if we take immediate and drastic action to reduce global warming.	51.9	73.9	0.050
Question 16: The actions of a single person won't make any difference in reducing global warming.	70.4	56.5	0.046
Part IV. Behavior			
Question 18: Recycle or return glass bottles, cans paper, and plastic containers	77.8	95.7	0.052
Part V. Knowledge			
Question 21: Which of the following is the most abundant greenhouse gas?	30.8	91.3	<0.001
Question 29: Select the diagram that best represents the transport of energy among Earth's surface, the atmosphere, and outer space.	66.7	91.3	0.257
Question 33: Global climate change is accelerated by the melting of snow and ice covered surfaces.	66.7	90.2	0.004
<i>*probability of post-pre difference calculated with Wilcoxin signed rank test.</i>			



Sample questions	Pre-course	Post-course
... most important problem facing US today	22% identified climate change	74% identified climate change
Global warming caused mostly by human activities	14.8%	82.6%
Climate change only impacts future generations	18.5%	4.3%
Currently ... try to save energy ...	29.6%	39.1%

# Poster ED11B-0781: Susan Lynds & Susan Buhr

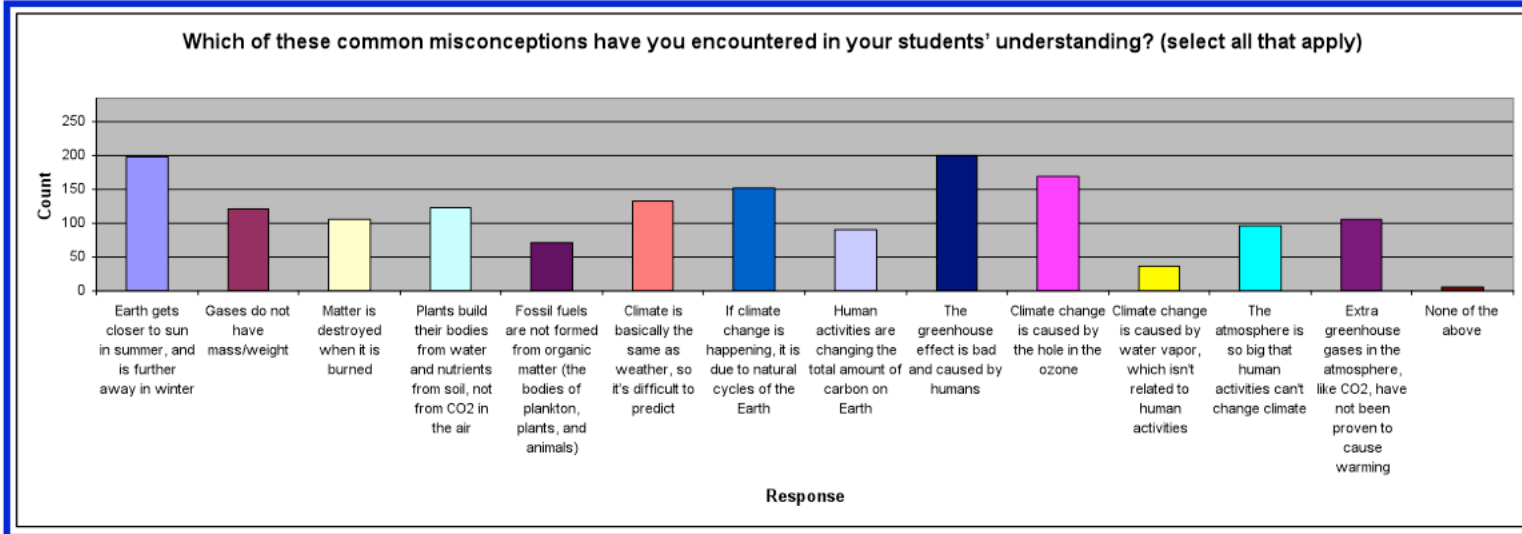
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- “Evaluating Programs that Promote Climate and Energy Education – Meeting Teacher Needs for Online Resources.”
- Focuses on CLEAN and ICEE, and how well they serve the needs of teachers for online resources.
- Evaluation plan incorporates:
  - Front-end needs assessment
  - Formative evaluations to refine workshops, webinars and meetings
  - Monitoring of web resource usage

# Multidimensional Evaluation in ICEE and CLEAN

Both CLEAN and ICEE use internal and external evaluation to enhance their effectiveness. Evaluation techniques support the creation of professional development opportunities, selection of online resources, design of meetings and webinars, and project reporting.

## ICEE Front –End Survey: Climate Science in the Classroom



The ICEE project began with a nationwide online survey to investigate educator needs and practices around climate science in the classroom. Respondents included 284 teachers of grades 6-12. The survey investigated a variety of topics including subjects in which climate is taught, technology used, and misconceptions.

## Workshop, Webinar, and Meeting Evaluation— Discovering and Refining Best Practices

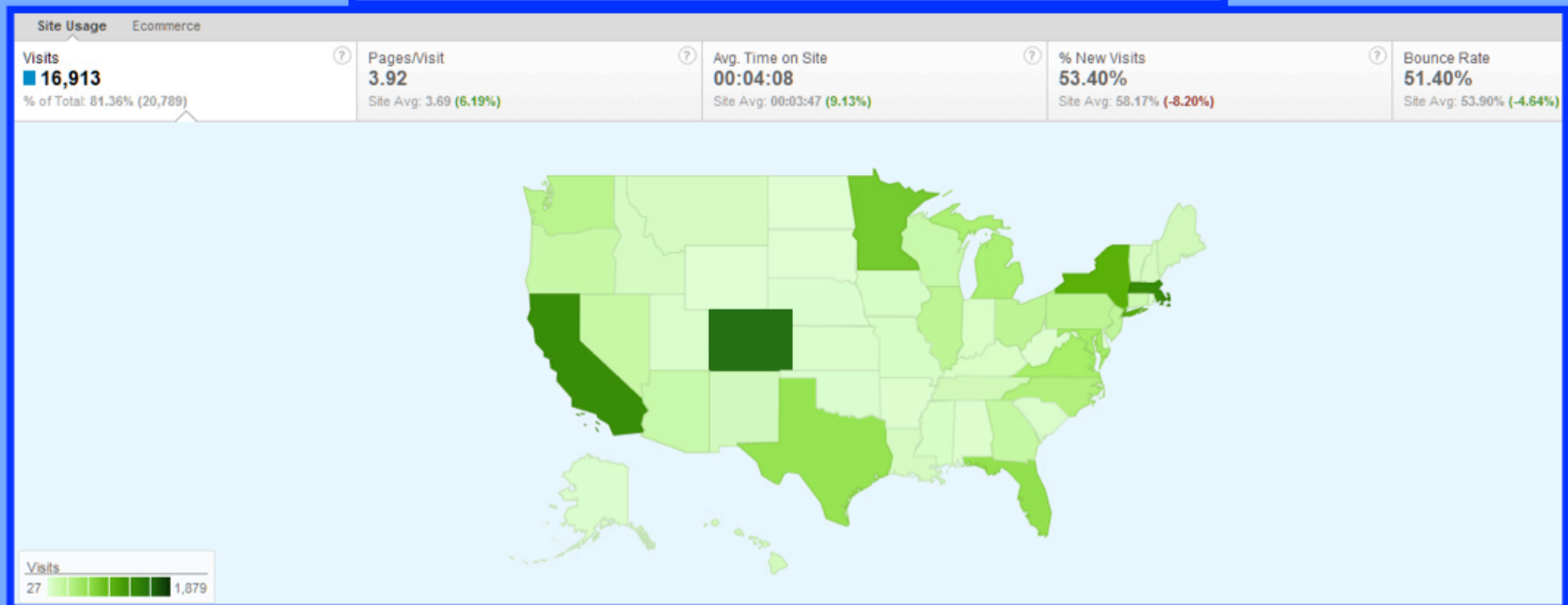
Events held for CLEAN and ICEE consistently include evaluation processes to gather participant feedback and measure achievement of program goals. Evaluation reports provide information to managers to fine-tune future events. Data are collected via

- observations, for qualitative analysis
- daily feedback surveys, used to fine-tune multi-day events in real time
- final feedback survey, for overall feedback on the event



ICEE Workshop 2010

## Web Statistics Monitor Online Use



A variety of usage data is monitored for ICEE and CLEAN, including posting activity levels on the ICEE Forum and Google Analytics statistics on the CLEAN site. Visitor locations for CLEAN during part of 2011 is shown.

# Poster ED11B-0784: Holthuis, Saltzman, Lotan, Mastrandrea, Diffenbaugh, Gray & Kloser

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- “Advancing Climate Change Education: Student Engagement and Teacher Talk in the Classroom.”
- Focuses on Stanford’s *Global Climate Change: Professional Development for K-12 Teachers* project.
- Poster presents a study of:
  - Quality of implementation
  - Student engagement in classroom work
  - The nature of teachers’ talk in the classroom
- Findings and suggestions
  - Teachers deliver factual content and discuss classroom procedure, and spend less time on scientific argumentation, reasoning, analysis.
  - Suggest that PD should include classroom management strategies and pay greater attention to teachers’ interactions with students.

## Science Teacher Talk Observation Instrument

Teacher: \_\_\_\_\_ Period: \_\_\_\_\_ Obs Day\* \_\_\_\_\_ Obs # \*\* \_\_\_\_\_ Date: \_\_\_\_\_ Lesson/Activity: \_\_\_\_\_

Scorer: \_\_\_\_\_ Start Time: \_\_\_\_\_ Stop Time: \_\_\_\_\_ Total mins \_\_\_\_\_ Whole Class \_\_\_\_\_ Groupwork \_\_\_\_\_ Individual \_\_\_\_\_

Instruction																	Total
Science Procedure/Materials																	
Data (collect, obs., record)																	
Factual/Recall																	
Interpret/Analyze/Infer																	
Evaluate/Apply																	
Connect (other lesson, st lives)																	
Class Procedure																	
<b>Student Interaction</b>																	
<b>Notes</b>																	

Instruction																	Total
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Evaluate/Apply																	
Connect (other lesson, st lives)																	
Class Procedure																	
<b>Student Interaction</b>																	
<b>Notes</b>																	

\* First, second or third day of observations.

\*\* First. Second, third, etc. observation that day/period.

## Science Student Engagement Instrument

Teacher: \_\_\_\_\_ Period: \_\_\_\_\_ \*Obs Day # \_\_\_\_\_ Date: \_\_\_\_\_ Lesson/Activity: \_\_\_\_\_ Scorer: \_\_\_\_\_

	Engaged/ Interacting (verbally)	Engaged (but not interacting)	Off-Task/ Disengaged	Total	
Time 1 _____					Whole Class <input type="checkbox"/> Groupwork <input type="checkbox"/> Individual <input type="checkbox"/>
Time 2 _____					Whole Class <input type="checkbox"/> Groupwork <input type="checkbox"/> Individual <input type="checkbox"/>
Time 3 _____					Whole Class <input type="checkbox"/> Groupwork <input type="checkbox"/> Individual <input type="checkbox"/>
Time 4 _____					Whole Class <input type="checkbox"/> Groupwork <input type="checkbox"/> Individual <input type="checkbox"/>
Time 5 _____					Whole Class <input type="checkbox"/> Groupwork <input type="checkbox"/> Individual <input type="checkbox"/>
Time 6 _____					Whole Class <input type="checkbox"/> Groupwork <input type="checkbox"/> Individual <input type="checkbox"/>
<b>TOTALS</b>					

\* First, second or third day of observations.

Julie Lambert (Florida Atlantic U), PI – CSI – South Florida  
Bob Bleicher (Cal State Channel Islands), Evaluator

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- Evaluation of FAU program looks at both knowledge and views/attitudes regarding GCC

**My Views on Global Climate Change (VGCC – Lambert & Bleicher, 2011)**

Please circle the number below to indicate your view on each topic.



1.	How informed do you feel about global climate change?	1 Not Informed	2	3	4	5 Very Informed
2.	How informed do you feel about the different causes of global warming?	1 Not Informed	2	3	4	5 Very Informed
3.	How informed do you feel about the different consequences of global warming?	1 Not Informed	2	3	4	5 Very Informed
4.	How informed do you feel about the actions that we can take to reduce global warming?	1 Not Informed	2	3	4	5 Very Informed
5.	How competent are you to evaluate scientific information about global climate change?	1 Not Competent	2	3	4	5 Very Competent
6.	How convinced are you that global warming is happening?	1 Not Convinced	2	3	4	5 Completely Convinced

## Knowledge of Global Climate Change (KGCC - Lambert & Bleicher, 2011)

*Circle the best response to each item. For each item, circle any words that you don't understand and write any comments that would help me improve the question or answers or any clarification for the reason that you chose the answer that you did.*

- Q1. Heat energy from the sun is moved to Earth when energy is transferred through \_\_\_\_.
- a. collisions from one molecule to another.
  - b. liquids and gases due to different densities.
  - c. empty space by electromagnetic waves.
  - d. none of these.
- Q2. The energy from the sun does all of the following **EXCEPT** \_\_\_\_.
- a. drives density-driven currents in the atmosphere and oceans
  - b. provides a source of energy for the Earth's water cycle
  - c. provides a source of energy for photosynthesis
  - d. provides a source of heat for the Earth's interior
- Q3. What is the most abundant substance in Earth's atmosphere?
- a. argon
  - b. carbon dioxide
  - c. nitrogen
  - d. oxygen
- Q4. The ozone layer helps life on the planet because ozone \_\_\_\_.
- a. absorbs infrared radiation from Earth.
  - b. absorbs ultraviolet radiation from the Sun.
  - c. reflects incoming solar radiation from the Sun.
  - d. modifies Earth's temperature.

# Preliminary Evaluation Plan for PEL

## Bob Bleicher & Kathy Comfort (WestEd)

Table 6. Research Questions, Data Sources, and Analysis.

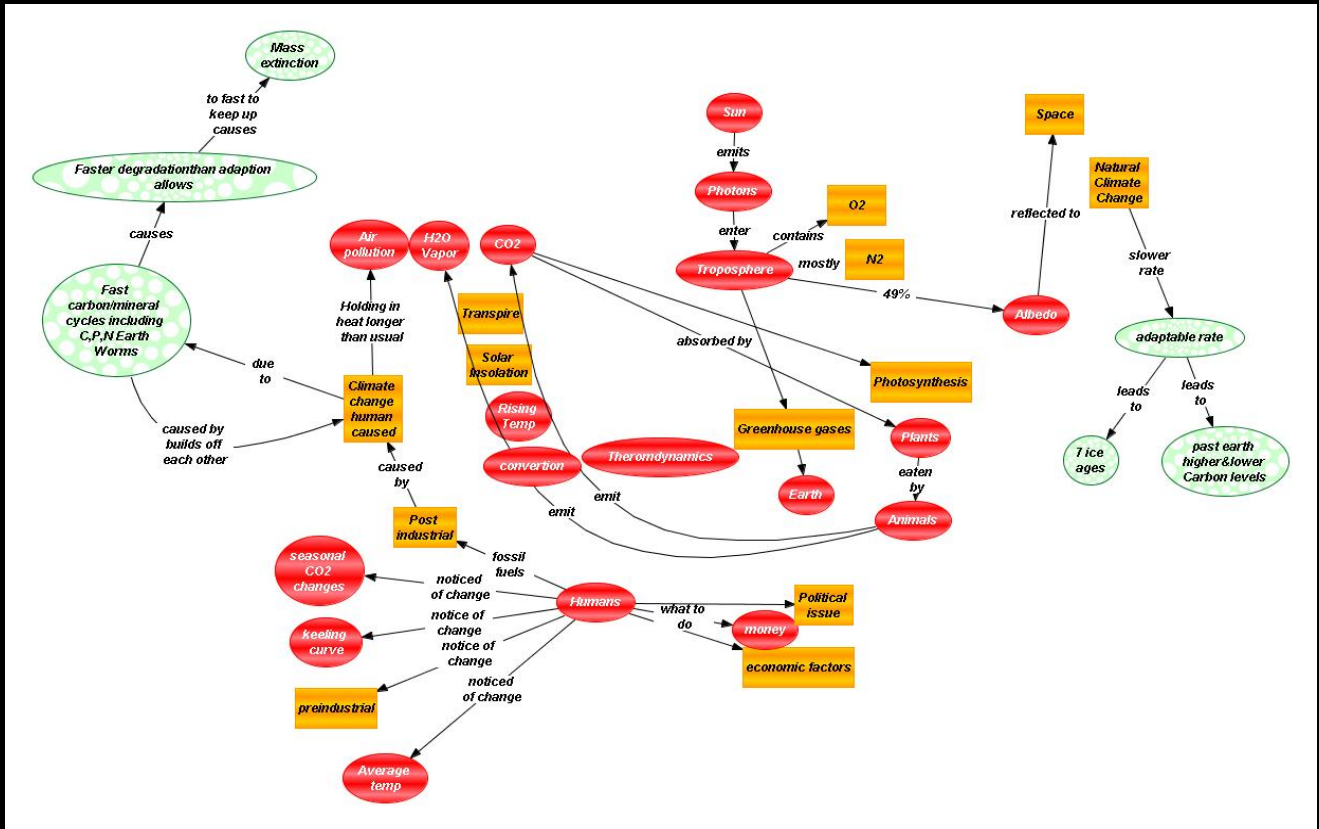
Research Questions	Data Sources	Analysis
<b>Student-level Outcomes</b>		
Is there evidence that students are more climate change science literate after PEL participation?	- Climate change literacy survey - Student presentations	- Pre-post comparisons; paired t-tests - Qualitative coding
Are there gains in science achievement scores among students in participating teachers' classes?	- District benchmark and teacher classroom assessments - GCC Knowledge instrument	- Hispanic - non-Hispanic student comparisons; analysis of co-variance
Does participating in PEL increase the likelihood that students will enroll in college STEM programs?	- University enrollment data - Student survey	- Pre-post comparisons; paired t-tests
How does PEL affect students' knowledge of GCC, their ability to engage with NASA data and models, and their ability to effectively communicate and present sound arguments based on data?	- Knowledge of Global Climate Change instrument - Student work samples - Videotaping student debates	- Pre-post comparisons; paired t-tests - Qualitative coding
Are students involved in community GCC projects?	- Project records and direct observations of student involvement (Videotaping and fieldnotes)	- Document analysis - Qualitative coding
<b>Teacher-level Outcomes</b>		
Are teachers more knowledgeable about and better prepared to teach GCC?	- GCC Knowledge instrument - Teacher focus group; reflection journals	- Pre-post comparisons; paired t-tests - Qualitative coding
Are there changes in teaching' self efficacy and outcome expectancy beliefs?	- GCC Efficacy Belief Instrument - Teacher survey, journals - Teacher focus group	- Pre-post comparisons; paired t-tests - Qualitative coding
Does CART support collaborative planning and teaching?	- Teacher surveys - Teacher focus group	- Pre-post comparisons; paired t-tests - Qualitative coding
<b>Curriculum Resources-level Outcomes</b>		
From a teacher's perspective, what are strengths and weaknesses in each of the 3 specific resources?	- Interviews - Videotaping CART meetings - Teacher surveys	- Qualitative coding
From a student's perspective, what are specific features in each of the 3 resources that contributed to learning?	- Student work samples - Classroom observations - Interviews	- Grading rubrics - Qualitative coding
<b>Program-level Outcomes</b>		
How successful was the partnership?	- Lead and partner agency staff interviews; observations at meetings	- Qualitative coding

# Oral ED24A-07: Campbell, Roehrig, Dalbotten, Bhattacharya, Nam, Varma & Wang

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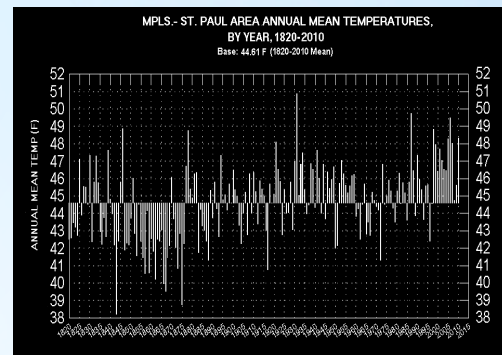
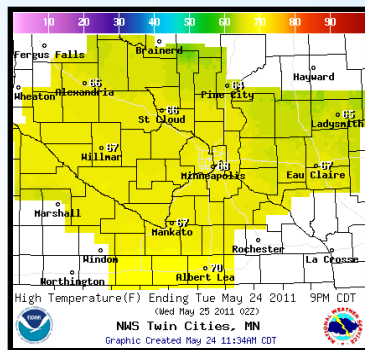
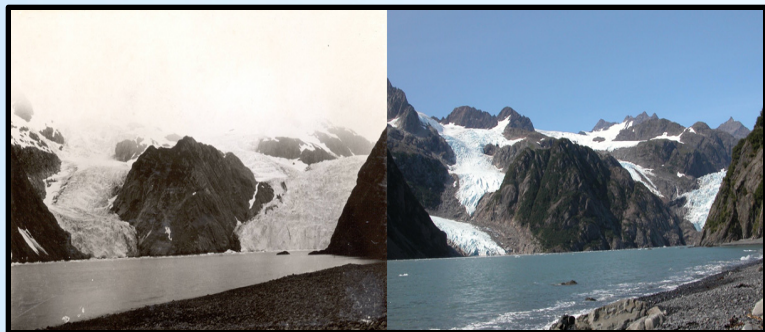
- “Conceptualizing In-Service Secondary School Science Teachers’ Knowledge Base for Climate Change Content.”
- Educational research focuses on the University of Minnesota’s *CYCLES: Teachers Discovering Climate Change from a Native Perspective* project, which delivers professional development and follow-up support.
- Research plan incorporates:
  - An interest in teachers’ attitudes and knowledge about both climate change and classroom practices, plus teachers’ knowledge of culturally-relevant approaches in native communities.

## 1919 COLLECTION

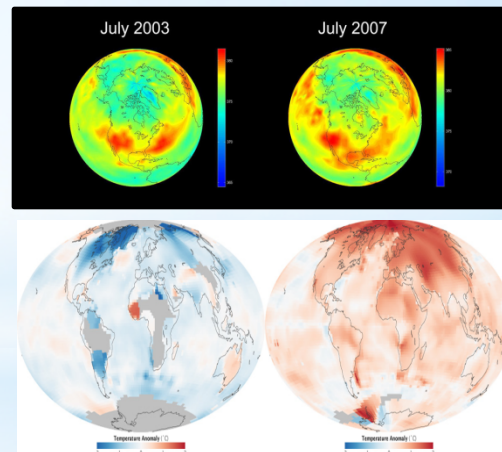
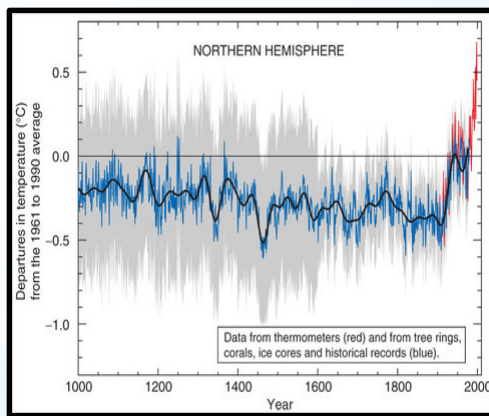
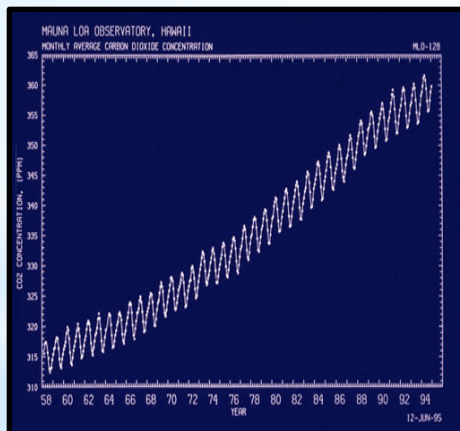


# CYCLES: Data Collection

## \* Photo Elicitation Interviews (PEI)



EFFECTS OF CLIMATE CHANGE	
Phenomenon	Likelihood
Warmer days. Less cold days/nights	Virtually certain
More warm spells and heatwaves	Very likely
More heavy rain events	Very likely
More areas hit by drought	Likely
More intense tropical cyclones	Likely
More extreme sea levels (not tsunamis)	Likely



# NWF Eco-Schools

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- “Eco-Schools USA Climate Change Connections (CCC).”
- Evaluation products include:
  - A toolkit for participating teachers, to help them administer evaluation instruments to their students.
- Evaluation plan incorporates:
  - Student and teacher surveys.
  - Interest in students’ knowledge of climate change, self-efficacy in taking action, and interested in STEM careers.
  - Interest in teachers’ knowledge and self-efficacy about technology, new pedagogical tools, and climate literacy.

## Introduction

### Evaluation Requirements for Teachers to Administer to Eco-Schools USA CCC to students:

1. **Pre- and Post-Student Surveys**
2. **First Word and Last Word for “climate change”**
3. **Reflection Tools for Each Module or Lesson**

Over the course of the year, teachers can build in many opportunities to assess how students are learning, providing feedback to both teachers and students. This evaluation toolkit offers a set of tools for assessing student learning, including: a schedule for completing all CCC evaluation activities, the survey that you will administer to students at the beginning and end of the CCC program; First Word/Last Word instructions and assessment tool, and reflection tools for the modules and lessons. These tools are an important component of our evaluation that help us to determine the effectiveness of the CCC program, and as well provide you information along the way about how and what students are learning.

#### Surveys

You are responsible for administering the survey to your students prior to implementing the curriculum, and then after you have completed your CCC unit **to the same group of students** (if at all possible). At the same time that you administer surveys to your CCC students, please choose a comparison group of students (same grade level) who did not participate in CCC and administer pre- and post-surveys **to the same group of students both times**.

#### First Word/Last Word

Please have students complete a First Word with “**climate change**.” Then, have students complete a Last Word with “**climate change**” (and do reflection activity) at some point after they have finished the unit. Please deliver these to your CCC staff.

#### Reflection Tools

Please choose at least one reflection tool to administer to students at the end of each module or lesson. You may choose either Head + Heart + Hands, Take a Stand, Justified True/False

# NWF Eco-Schools CCC 2011 Evaluation Plan v1a

Category	Evaluation Questions and/or Descriptions	Evaluation Strategy/Activity	Personnel Accountable	When	Approx. % of eval plan
1. Cohort 1	<p>* What are the primary challenges to program implementation and how are they resolved?</p> <p>* To what extent did participating educators change their teaching of climate change, self-efficacy in the use of NASA data, and technology content knowledge?</p> <p>* How did the program impact students' knowledge and understanding of climate change, self-efficacy with respect to taking action on climate change, and interest in STEM-related activities and careers?</p>	a) Analyze check-in interviews conducted by NWF staff in February 2011 (Interview questions first sent out to teachers, then NWF staff fill in additional answers within Survey Monkey).	PEER lead/NWF support	11-Mar	14%
		b) Develop and analyze surveys of educators to follow Webinars conducted by NWF staff. Analyze student surveys and Authentic Assessment tools.	PEER lead/NWF support	Summer 11	14%
		c) Present utilization-focused findings from Cohort 1 data, and recommendations for working with Cohort 2 in summary format plus phone conversation.	PEER lead/NWF support	Summer 11	21%
2. Cohort 2	<p><b>Initial Survey/Interview:</b></p> <p>* How did participants perceive the workshop?</p> <p>* To what extent did participants change the level of their knowledge and self-efficacy about climate change science and literacy, technology, and new pedagogies?</p> <p>* To what extent did participants experience intent to change their educator practice?</p>	d) NWF administer and analyze (with guidance from PEER) pre-training survey/ application for participating educators.	NWF lead/ PEER support	Spring 11	4%
		e) Analyze and present utilization-focused findings from Cohort 2 post-institute <b>online</b> survey.	PEER lead/NWF support	Summer 11	14%
		f) Analyze baseline implementation fidelity data and <b>online</b> student surveys	PEER lead/NWF support	Winter 11	11%
4. Program Staff Support	* How can program evaluators support program implementation and dissemination?	g) Help NWF prepare for NASA conferences/ presentations	PEER	ongoing	7%
	* How has the intended use of evaluation data and products compared to actual and anticipated use?	h) General, on-going support for utilization of evaluation results and program documentation. Participate in utilization follow-up conversation.	PEER	ongoing	7%
	* Integrating plans with budgets, accounting.	i) Administrative, financial management support	AAP	ongoing	7%

# Group Discussion

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- Major evaluation questions of interest on your project?
- Approaches and designs?
- Useful, innovative tools or instruments?